

Jericho Cain, PhD

+1-301-346-4864 | jericho.cain@gmail.com | jerichocain.com





 [jericho-c-96095287](https://www.linkedin.com/in/jericho-c-96095287) |  [jericho-cain](https://github.com/jericho-cain) |

Vancouver, WA - 98683, USA



RESEARCH FOCUS

Gravitational-wave data analysis; machine learning for astrophysical inference; time–frequency methods; unsupervised and manifold-based learning; confusion-limited source separation for LISA; template-free detection methods for ground-based detectors; physics-informed machine learning.

ACADEMIC APPOINTMENTS

- **Portland Community College**  01/2024–Present
Portland, OR
Adjunct Physics Instructor (Weekend Teaching)
 - Teach algebra-based physics with integrated laboratory sessions to pre-medical students.
 - Incorporate discussions of advanced physics concepts and emerging roles of AI and deep learning in scientific discovery.
- **U.S. Army Research Laboratory**  08/2013– 12/2015
Adelphi, MD
Research Physicist
 - Conducted theoretical and computational research in atmospheric acoustics and turbulence.
 - Adapted ocean acoustics Green’s function methods to atmospheric turbulence modeling, advancing sound-propagation prediction accuracy.
 - Contributed to the theory of statistical moments of acoustic signals in turbulent media using Python-based simulations.
- **University of Mississippi**  08/2006 – 08/2013
Oxford, MS
Graduate Researcher and Instructor
 - Participated in the LIGO project, performing data analysis, detector characterization, and Astrowatch operations during the O1 science run.
 - Developed a large-eddy simulation of atmospheric dynamics over terrain to study turbulent gust effects and ground-level pressure responses for early-warning wind turbine detection.
 - Taught calculus-based and algebra-based physics, astronomy, and associated laboratories; mentored ROTC cadets and undergraduate students.
- **Georgia State University**  08/2004 – 08/2006
Atlanta, GA
Undergraduate Lab Instructor
 - Taught algebra-based physics and physical science laboratory courses; supported curriculum delivery and student mentorship as an undergraduate instructor.

EDUCATION

- **University of Mississippi**  August 2007 – May 2013
Oxford, MS, USA
Ph.D. in Physics
 - Dissertation research focused on large-eddy meteorological modeling to simulate complete atmospheric systems and develop ground-based detection algorithms for wind gusts.
 - Conducted research with the LIGO collaboration at Hanford, WA and Livingston, LA, including interferometer operations and data analysis.
- **Georgia State University**  August 2003 – May 2007
Atlanta, GA, USA
Bachelor of Science in Physics
 - Received the Robert H. Hankla Award for Outstanding Senior Physics Student.
 - Served as an undergraduate laboratory instructor for algebra-based and physical science courses.


- [J.1] Jericho Cain (2025). **Template-Free Gravitational Wave Detection with CWT-LSTM Autoencoders: A Case Study of Run-Dependent Calibration Effects in LIGO Data**. *Classical and Quantum Gravity*, 2026. DOI: 10.1088/1361-6382/ae415e
- [J.3] Vladimir E. Ostashev, D. Keith Wilson, Sandra L. Collier, Jericho Cain, Sylvain Cheinet (2016). **Cross-frequency coherence and pulse propagation in a turbulent atmosphere**. *Journal of the Acoustical Society of America*, Vol. 140, Issue 1, pp. 678. DOI: 10.1121/1.4959003
- [J.4] LIGO Scientific Collaboration (incl. Jericho Cain) (2010). **Methods for Reducing False Alarms in Searches for Compact Binary Coalescences in LIGO Data**. *Classical and Quantum Gravity*, 27(16):165023. DOI: 10.1088/0264-9381/27/16/165023
- [S.1] Jericho Cain (2026). **Manifold Learning for Source Separation in Confusion-Limited Gravitational-Wave Data**. Under revision at *Classical and Quantum Gravity*. arXiv:2511.12845. DOI: 10.48550/arXiv.2511.12845
- [S.2] Jericho Cain and Hayden Beadles (2026). **Mask-Based Window-Level Insider Threat Detection for Campaign Discovery**. Manuscript submitted for publication in *IEEE Transactions on Information Forensics and Security*. arXiv:2511.12845. DOI: 10.48550/arXiv.2602.11019
- [S.3] Jericho Cain (2026). **Detectability Scaling Laws for Environmental Phase Modulation in Gravitational-Wave Signals**. Manuscript submitted for publication in *PRD*. arxiv:2602.17725. DOI: 10.48550/arXiv.2602.17725
- [S.4] Jericho Cain (2026). **Likelihood-Based One-Class Scoring in CWT Latent Space for Confusion-Limited LISA Gravitational-Wave Detection**. Manuscript submitted for publication in *Classical and Quantum Gravity*. arxiv:2602.20212. DOI: 10.48550/arXiv.2602.20212
- [S.5] Jericho Cain (2026). **Gauge Freedom and Metric Dependence in Neural Representation Spaces**. Manuscript submitted for publication in *JMLR*. arxiv:2603.06774. DOI: 10.48550/arXiv.2603.06774
- [C.1] Alexander Heye, Karthik Venkatesan, Jericho Cain (2017). **Precipitation Nowcasting: Leveraging Deep Recurrent Convolutional Neural Networks**. In *Proceedings of the CUG 2017 Workshops*, pp. 1–8.
- [C.2] Jericho E. Cain, Sandra L. Collier, Vladimir E. Ostashev, David K. Wilson (2015). **Signal coherence of broadband sound propagation through a refractive and turbulent atmosphere**. *Journal of the Acoustical Society of America*, 137(4_Supplement), 2224–2224.
- [C.3] Sandra L. Collier, Jericho E. Cain, John M. Noble, David A. Ligon, W. C. Kirkpatrick Alberts, Leng K. Sim (2015). **Green's function retrieval for atmospheric acoustic propagation**. *Journal of the Acoustical Society of America*, 138(3_Supplement), 1754–1754.
- [C.4] Jericho Cain (2016). **Effects of turbulence on acoustic impulses propagating near the ground**. In *Proc. French Acoustics Congress & Conference on Vibrations, Shocks, and Noise*. Conference presentation, Apr 11, 2016.
- [C.5] Jericho E. Cain (2015). **Statistical moments of a wideband acoustic signal**. *Proceedings of Meetings on Acoustics*, Vol. 21.
- [C.6] Jericho Cain, Sandra Collier, Vladimir Ostashev, D. Keith Wilson (2014). **Spatial coherence function for a wideband acoustic signal**. *Journal of the Acoustical Society of America*, 135(4_Supplement), 2382–2382
- [C.7] Jericho E. Cain, Sandra L. Collier, John M. Noble, David A. Ligon, W. C. K. Alberts, Leng K. Sim (2016). **Inverse methods for Green's function retrieval**. *Journal of the Acoustical Society of America*, 139(4_Supplement), 1985–1985.
- [C.8] Jericho Cain, Richard Raspet (2011). **Detection of turbulence aloft by infrasonic wind noise measurements on the ground**. *Journal of the Acoustical Society of America*, 130(4_Supplement), 2437–2437.
- [C.9] Roger Waxler, Kenneth E. Gilbert, Jericho Cain (2008). **The Radiation of Microbaroms from Isolated Hurricanes over Water**. *AIP Proceedings*, 1022(1), 417–427. DOI: 10.1063/1.2838136
- [T.1] Jericho Cain (2013). **Large Eddy Simulation of Surface Pressure Fluctuations Generated by Elevated Gusts**. Ph.D. thesis, University of Mississippi. Available at: egrove.olemiss.edu/etd/771/.

RESEARCH PROGRAM: PHYSICS-FIRST MACHINE LEARNING FOR GRAVITATIONAL WAVE


• **Template-Free Detection for Ground-Based Detectors (LIGO)**

This research thrust develops discovery-oriented, template-free methods for gravitational-wave detection that complement matched filtering by prioritizing robustness, interpretability, and sensitivity to unmodeled signal morphologies. The central philosophy is to encode as much physical structure as possible in the representation stage, allowing comparatively simple machine-learning models to operate in a physically meaningful feature space.



- Development of continuous wavelet transform (CWT) representations explicitly aligned with the time–frequency evolution of compact binary coalescences and other transient gravitational-wave signals, rather than relying on generic spectrograms.

- Systematic investigation of wavelet families (e.g., Morlet, generalized analytic, and other physically motivated bases) to determine which wavelets optimally expose specific signal morphologies within the LIGO sensitivity band.
 - Current focus on matching wavelet structure to theoretically predicted but poorly modeled or exotic gravitational-wave sources, with the goal of enhancing sensitivity of template-free anomaly-detection pipelines to signals outside existing template banks.
 - Unsupervised noise modeling and anomaly detection trained exclusively on real detector noise, enabling signal discovery without reliance on waveform templates or labeled training data.
 - Injection of theoretical waveforms into authentic LIGO noise to quantify detection efficiency as a function of wavelet choice, signal morphology, and noise non-stationarity.
 - Application of optimized wavelet-based pipelines to unlabeled archival LIGO data as a discovery search for anomalous or unexpected gravitational-wave signatures.
 - Accepted for publication in *Classical and Quantum Gravity*.
- **Source Separation in Confusion-Limited Regimes (LISA)**  [G]
This research direction addresses the fundamentally different data-analysis challenges posed by space-based detectors, where observations are expected to be signal-dominated and limited by source confusion rather than instrumental noise.
 - Development of unsupervised source-separation methods based on the geometric structure of latent representations learned from confusion-dominated gravitational-wave backgrounds.
 - Use of manifold learning techniques to distinguish resolvable sources from the unresolved Galactic foreground without reliance on matched filtering or detailed source catalogs.
 - Construction of fully synthetic, end-to-end LISA data-analysis pipelines designed to be reproducible and accessible to undergraduate and master's-level student researchers.
 - Emphasis on methods that scale naturally with increasing source density, positioning this work for direct relevance to LISA mission readiness and early data challenges.
 - Manuscript submitted for publication in *Classical and Quantum Gravity*.
- **Physics-Informed Machine Learning Methodology**
Across both ground- and space-based applications, this program emphasizes machine-learning approaches that are guided by physical insight rather than architectural complexity.
 - Preference for interpretable, minimalist models whose behavior can be understood in terms of signal physics and detector characteristics.
 - Strategic use of physics-informed preprocessing (time–frequency representations, normalization choices, and domain-specific constraints) to reduce reliance on highly over-parameterized models.
 - Commitment to open-science practices, including fully reproducible pipelines, public code release, and transparent reporting of negative results and systematic effects.

TEACHING EXPERIENCE

- **Portland Community College**  01/2024 – Present
Adjunct Physics Instructor Portland, OR
 - Physics 201: General Physics I. Topics include mechanics including statics, forces and motion energy, collisions, circular motion and rotational dynamics.
 - Physics 202: General Physics II. Topics include mechanical properties of matter, heat, waves, sound and light.
 - Physics 203: General Physics III. Topics include electricity, magnetism and radioactivity.

INDUSTRY RESEARCH EXPERIENCE

- **Adobe**  11/2022 – Present
Senior Staff Data Scientist / Research Scientist Remote
 - Led research and development of unsupervised and semi-supervised anomaly-detection models for large-scale time-series data.
 - Designed deep learning architectures based on autoencoders and sequence models, with emphasis on interpretability and robustness to non-stationary data.
- **ConcertAI**  10/2020 – 11/2022
Principal Data Scientist Remote
 - Architected machine-learning pipelines for inference on incomplete, noisy, and heterogeneous clinical datasets.
 - Developed interpretable statistical and machine-learning models with explicit uncertainty and feature attribution.

- **Change Healthcare** [🌐]

Senior Data Scientist

08/2017 – 10/2020

Emeryville, CA

- Developed machine-learning models for large-scale text and time-series analysis, outperforming manual review processes.
- Implemented scalable training and inference pipelines using PyTorch, TensorFlow, and distributed computing frameworks.

- **Cray Inc.** [🌐]

Data Scientist II

01/2016 – 08/2017

Seattle, WA

- Applied machine learning and high-performance computing to scientific and engineering problems, including spatiotemporal prediction.
- Developed recurrent neural-network models for geophysical forecasting, resulting in a peer-reviewed publication.

TECHNICAL COMPETENCIES

- **Scientific Programming & Computing:** Python, C++, Fortran, MATLAB, Mathematica
- **Gravitational-Wave & Signal Analysis:** GWPy, time–frequency analysis, continuous wavelet transforms, LIGO/LISA data analysis
- **Machine Learning for Physical Sciences:** PyTorch, unsupervised learning, representation learning, anomaly detection
- **Numerical & Statistical Methods:** Bayesian inference, numerical methods, optimization, statistical modeling
- **Scientific Libraries & Visualization:** NumPy, SciPy, Pandas, Matplotlib, Jupyter
- **High-Performance & Reproducible Computing:** Parallel computing on HPC systems, version control (Git), containerized workflows
- **Research & Teaching Competencies:** Scientific writing, curriculum design, undergraduate and graduate mentorship

AWARDS AND HONORS

- **Robert H. Hankla Award**

Georgia State University

2007 [🌐]

- Presented annually to the outstanding senior physics student for academic excellence and research contributions.

ADDITIONAL INFORMATION

Languages: English (Native)

Interests and Hobbies: Astrophotography, Chess, Woodworking